AN AUTOGRAPHIC RECORDING INSTRUMENT FOR TENSION TESTS.

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Read (by title) before the Academy, at Topeka, December 31, 1904.

THIS particular recording instrument, for tension tests of steel and iron, was designed and built by the author, for use with the Tinius-Olsen testing-machine, in the testing laboratory of the University of Kansas.

This testing-machine is of 100,000 pounds capacity, and is used for tension, compression and transverse tests of the strength of various materials.

The autographic recording instrument is shown in the photographs, plate VI and plate VII, in place, on a test piece. The instrument is usually left on the test piece until the curve begins to fall. This signifies that the maximum strength of the test piece has been reached; and the instrument is then removed, so that it may not be injured when the test piece is broken. Plates VI and VII are similarly lettered.

The drum, D, which holds the cross-section paper upon which the test is to be recorded, is revolved by the elongation of the test piece.

The pens, P_1, P_2, P_3, and P_4, move parallel to the axis of the drum, and proportionally to the load on the piece which is being tested.

The instrument is fastened to the test piece by the clamps, C; the distance between the upper and lower clamp screws being eight inches.

The rack, R, is connected by a rod to the upper clamp. This rack has sixteen teeth per inch, and meshes with a pinion of sixteen teeth. This pinion is pinned to the same shaft with the gear G_1, of 254 teeth. Gear G_1 meshes with gear G_2, of forty teeth. Gear G_2 is pinned to the shaft of the drum, D. The circumference of the drum is $7\frac{7}{8}$ inches.

If the piece under test is elongated one inch, the relative movement of the rack and pinion is one inch, and the pinion and the gear G_1 each make one revolution. At the same time the drum makes $\frac{254}{40}$ revolutions, and the length of the cross-section paper passing under the pens is $\frac{254}{40}$ by $7\frac{7}{8}$ inches, or 50.0006 inches, or, practically, 50 inches. Thus the elongation of the test piece is magnified fifty times.

Each of the pens, P_1–P_4, is mounted on a short barrel, which slides on the rod, A. Each barrel has a V projection, which reaches into the threads of the lead screw, S.

The lead screw, S, is connected by means of a flexible shaft, B, to

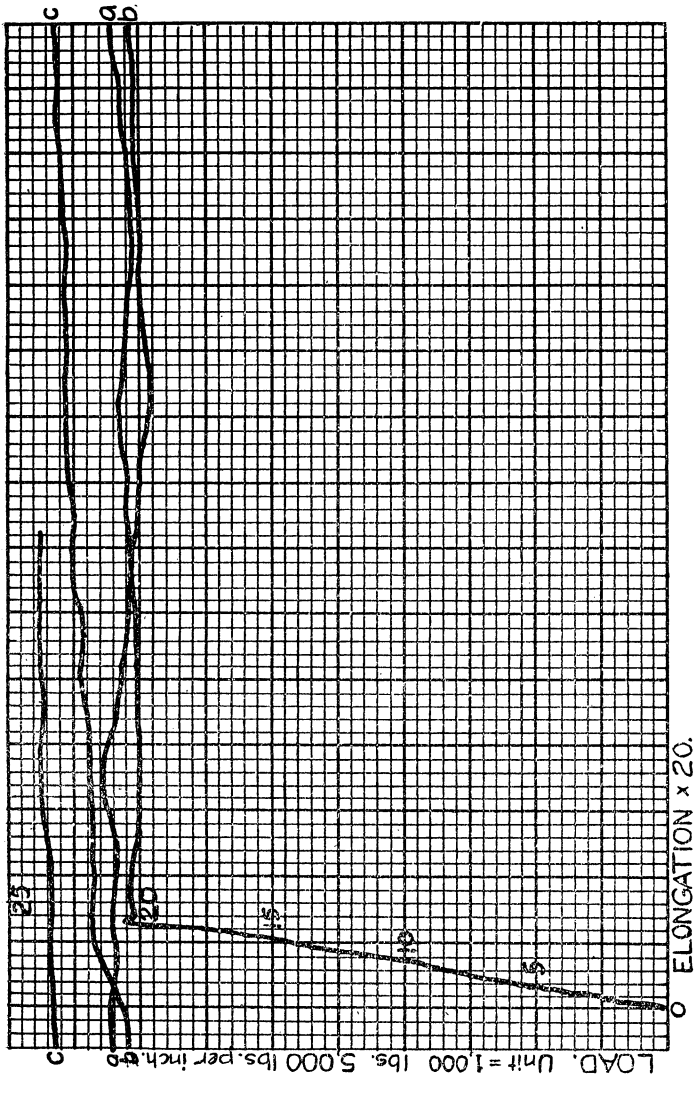

FIG. 3. Tension Test of MACHINERY STEEL, 3/4" dia. as rolled.

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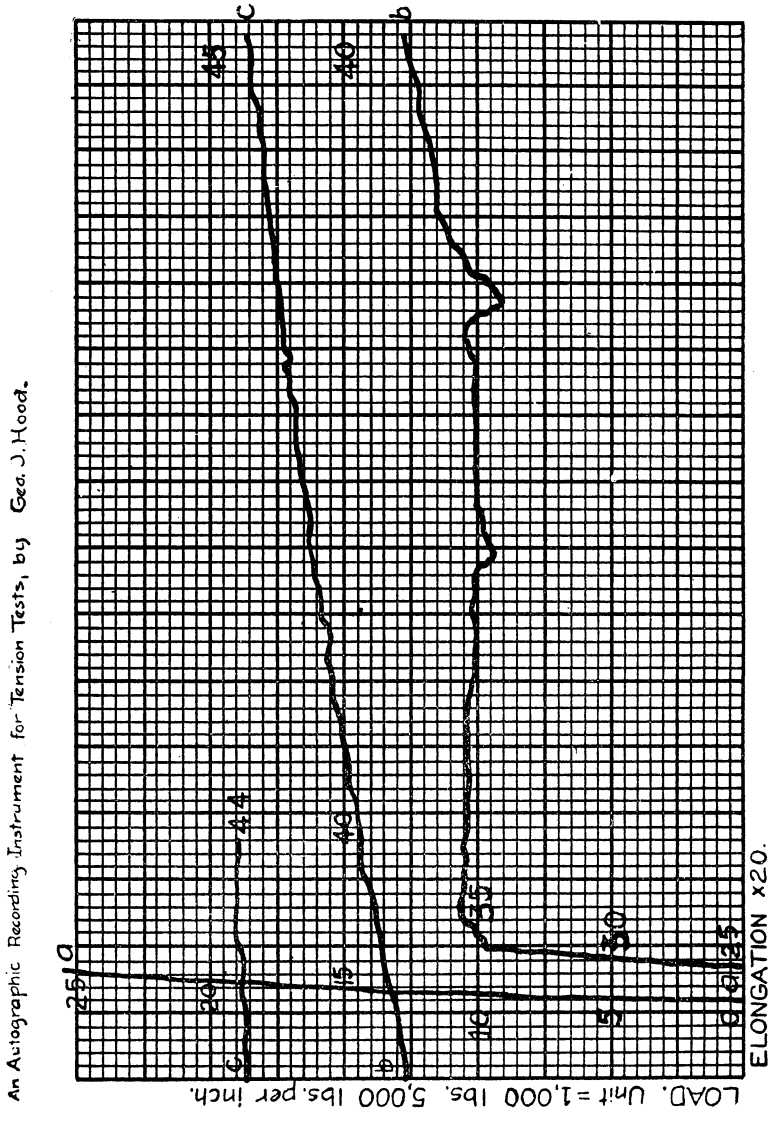

FIG. 4. Tension Test of WROUGHT IRON. 1"x1" as rolled.

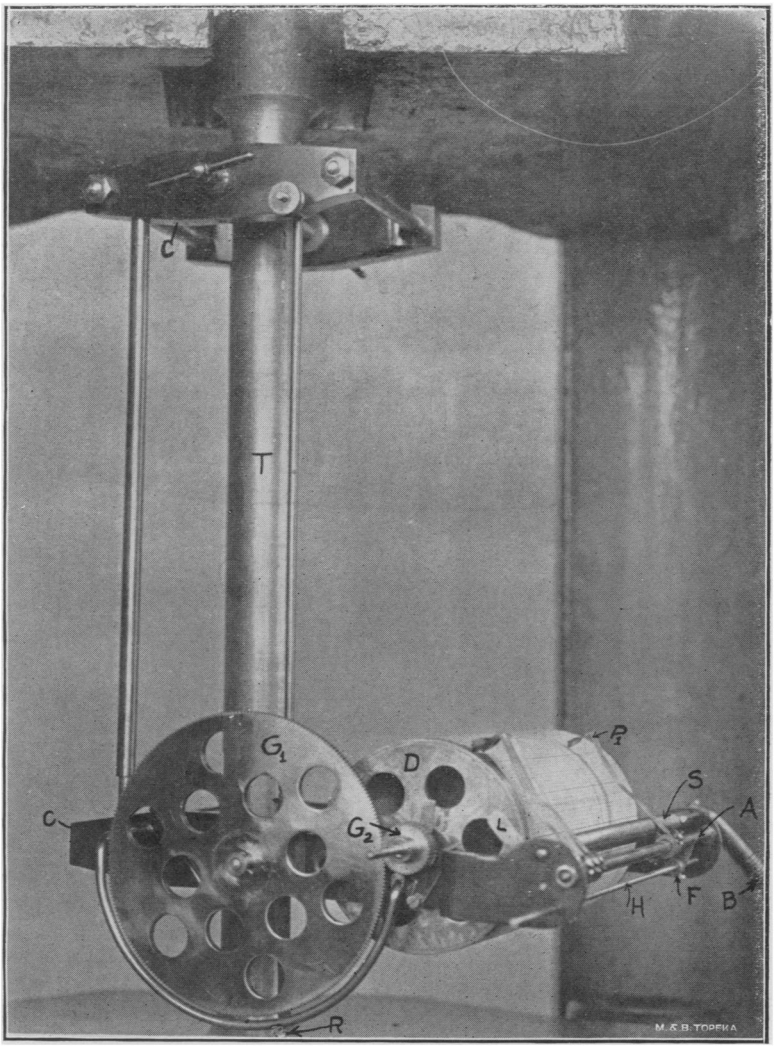

PLATE VII.—An Autographic Recording Instrument for Tension Tests (end view).

the shaft, M. The casing, K, surrounds a gear of 144 teeth, which makes one revolution for every 2000 pounds increase of load on the test piece. On the shaft, M, is mounted a gear of eighteen teeth, which meshes with the gear of 144 teeth, and thus makes one revolution for every 250 pounds change in load.

The screw, S, has twenty threads per inch, and the resulting load is, therefore, 250x20, or 5000 pounds per inch.

The capacity of the testing-machine being 100,000 pounds, and the suitable load scale being 5000 pounds per inch, it would require a drum twenty inches long. Instead of this, the drum is made five inches long, and four pens are arranged so as to have a total movement of twenty inches. The pens move from left to right with increase of load.

As pen P_1 reaches the end of its travel it presses against the finger F_1, which in turn moves the shifting-rod, H, causing finger F_2 to move the pens P_2, P_3 and P_4 to the right, until the pen P_2 is meshed with the lead screw, and takes up the curve five inches behind the pen P_1. In a similar manner the four pens supplement each other, either on increase or decrease of load.

The lever, L, operates a cam which releases the pens, so that the drum may be removed.

The rack, R, is held in mesh with its pinion by a spring, which allows the rack to slip in case the test piece should break with the recording instrument in place.

Figures 3 and 4 are two typical curves as drawn by the instrument.

The instrument is fairly satisfactory as it stands, but might, to advantage, have the lesser work of moving the pens accomplished by a mechanism actuated by the elongation of the test piece. The drum would then be rotated proportionally to the load. This would do away with the considerable strain between the upper and lower clamps caused by the high ratio of gearing and the inertia of the drum.